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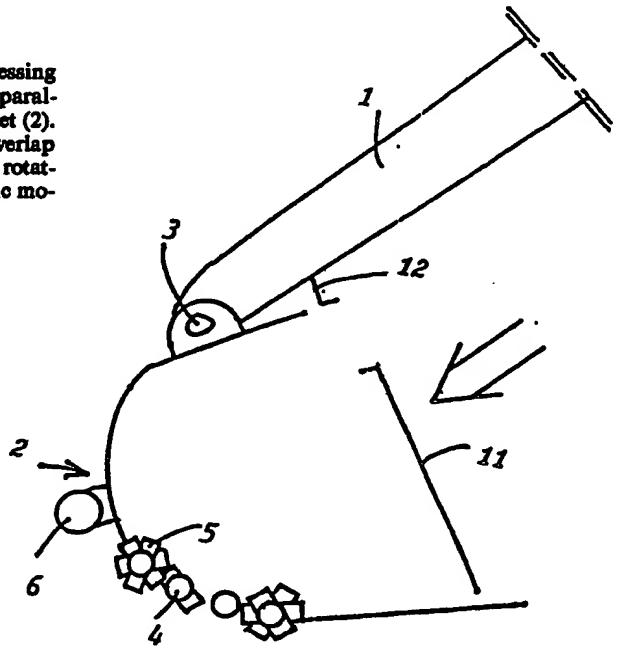
(54) Title: A DEVICE FOR SOIL PROCESSING

(57) Abstract

The object of the invention is a device for processing soil, especially topsoil, comprising, for example, a set of parallel, transversal shafts (4) mounted on an excavator bucket (2). The shafts are provided with blades (5), arranged to overlap the blades (5) of the adjacent shaft (4). The shafts (4) are rotated synchronously, particularly with the aid of a hydraulic motor (6).



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A device for soil processing

The present invention relates to a device for processing soil, particularly topsoil, or the like. Such processing aims to produce soil of homogeneous quality and, as such, well-adapted for the intended use.

Soil, especially topsoil, is conventionally processed by rotatable large screening drums, commercially available on the market at a relatively high price. Apart from the high price, screens also have other drawbacks. Namely, a large screening plant is difficult to move from one place to another. Such transportation is, however, often an essential operation because, for example, the processing of topsoil is carried out on one field at a time.

A further drawback of large screening devices is that for proper operation they require a bucket loader or excavator for input loading, and preferably another similar device for loading already-screened soil onboard the transport vehicle.

Yet another disadvantage that should be mentioned is that a screening drum actually becomes inoperative during rain because topsoil in particular becomes pasty in rain and does not pass through the screen.

A tractor loader bucket construction comprising transversal shafts provided with projections is known from German publication DE-OS 3046474. The purpose of the device is to cause the loaded material to move, to ensure the emptying of the bucket.

The aforementioned device is unsuitable for the pulverization of any type of soil, and it produces no screening effect whatsoever. The loading of said device with material containing rock fragments and similar solids would result in the rapid breakage of the device.

The object of the present invention is to avoid the drawbacks of prior art and to provide a device for processing soil where the cost of the device is only a fraction of the cost of a screening drum, which in its most advantageous embodiment travels with the excavator without a separate base or the like, allowing all the functions included in the loading to be performed at the same time. The device of the present invention further allows the processing of soil, for example, to be carried out even in rain and also under other wet conditions.

The advantages of the present invention are achieved with a device, the characteristics of which are specified in the enclosed claims. The basic idea of the invention is to replace the conventional rotating screening drum with a granulator consisting of at least two shafts with suitable blades secured thereto, which overlap one another when the shafts are rotated. The shafts are rotated in synchronization with each other so that material not wanted in the processed soil is prevented from going between the blades. Especially in the processing of topsoil, stones and roots usually found in such soil are not wanted in the end product. The device according to the principle of the invention, provided with a suitable actuator and transmission mechanism, can thus be used, for example, in carriage-type arrangements or, most preferably, as arranged to form a part of the bucket.

The invention is now described in more detail with reference to the enclosed drawings, where

Fig. 1 shows a simplified section of the device according to the invention, arranged into the excavator bucket according to the preferred embodiment, and

Fig. 2 shows a simplified partial section of the same device in the direction of arrow Fig. 2 shown in Fig. 1.

The device according to the invention shown in the figures

represents, as mentioned above, an embodiment of the invention which is considered an application, where all the advantages of the invention are implemented in the best possible manner. As will be explained later, this is not, however, the sole application of the invention, but is presented as one example which clearly reveals the advantages of the invention compared to prior art.

The device according to the present invention is arranged, in Fig. 1, into a standard excavator bucket, or a bucket especially constructed for this purpose. The presentation is a very much simplified version just to show the basic principle of the device. The bucket boom of the excavator is indicated by referece number 1 in the figure. It is a conventional bucket boom comprising, in any case, a bucket 2 on its end, the movements of which are controlled by the excavator operator from the driver's cabin generally by adjusting a hydraulic cylinder, which is not shown in the figure for clarity's sake, and which turns bucket 2 at articulate 3. The bucket can generally be joined to the end of boom 1 simply and quickly, just like the bucket of an excavator can be changed for different purposes.

Bucket 2 has transversal shafts 4 secured thereto, which are situated at a distance from each other, and with both ends mounted in bearings, usually at the lower part of the side walls of the bucket. For practical reasons, transversal shafts are more convenient, while longitudinal shafts serve the purpose equally well. Shafts 4 are provided with blades 5, usually welded on, which are generally evenly spaced along the length of the shaft. The direction of blades 5 can be slightly slanting with respect to the shaft cross-level. The same shaft cross-section may comprise, e.g., four blades 5. Looking in the longitudinal direction of shaft 4, from its end, the blades in the subsequent set of four blades may sit at angles to the corresponding blades in the preceding set, and at a little (for example about 5 cm) greater distance from the observer. The angle between

blades 5 of the successive sets of blades can be, for example, 30-60°. Experimental tests have proved an angle of 45° to be appropriate.

The blades may be arranged on the shaft in a corkscrew-like manner. The corkscrew-like manner can be so arranged that the direction of rotation of the corkscrew changes in the middle of the shaft, and the thread starting from the ends of the shaft and coming from both directions consequently ends in the middle of the shaft. The shaft can also be pivoted in the middle when so required. In the case of long shafts, this is absolutely necessary.

The device may also be provided, if necessary, with cinder sheet 11, which protects the cabin glass of the excavator and the driver from possible flying objects. Cinder sheet 11 can be arranged in any suitable manner so that it can be placed into exemplary crook 12, by moving bucket 2, where it remains while the excavator driver scoops, with bucket 2, a new batch to be processed. On returning the bucket to the processing position, the cinder sheet can be placed in front of the bucket to prevent the hurling of rocks or other objects.

The number of shafts is not critical; preferably at least two shafts 4 are required, however. The pulverization and mixing of soil occurs between the shafts. Since the working velocity suffers from a lesser number of shaft blades, it is preferable to place at least 4 to 5 shafts with blades, on bucket 2. Shafts 4 are rotated synchronously with the aid of a hydraulic motor, for example, which is schematically indicated by reference number 6. A chain gear via suitable sprocket wheels, or transmission effected by pinions, can well be used as the means of power transmission.

The device according to the invention can be implemented by at least two appropriate methods. When using a standard bucket, a suitable opening is cut in the bottom of bucket

2, and bearing lugs are secured on both side walls of the bucket, convenient in respect to the opening and on which shafts 4 are pivoted. The reciprocal position of the shafts in respect of the direction and point of rotation is set so that, as explained later, the drawbacks caused by rocks and the like are overcome. In addition, only the installation of a suitable actuator such as a hydraulic motor and a power transmitting device such as a chain is required.

In the other method, the device according to the invention is arranged, as a package, in position into the mouth of the bucket, either the old bucket which has a suitable opening cut into it, or into the mouth of a bucket provided with an opening particularly for this device; the device is attached to the bucket either by welding or, for example, by bolts, and the assembly is provided with an actuator and a power transmitting chain or the like.

Fig. 2 shows a partial view of the bottom of bucket 2 as viewed in the direction of arrow Fig. 2 in Fig. 1. Consequently, shafts 4 run between side walls 8, 9 of bucket 2, and are pivoted on them or in their proximity by bearings 7. The other end of the shaft is provided, for example, with sprocket wheel 10, on which a driving chain is fitted (not shown). The driving power for the chain is supplied, for example, by hydraulic motor 6, illustrated in Fig. 1. The driving motor is an advantageous alternative, since excavators are already equipped with hydraulic systems for driving the hydraulic motor. Another provision uses, for example, an enclosed cogged wheel system.

Blades 5 are so arranged on shafts 4 that blades 5 of adjacent shafts 4 overlap each other. There are only shown some blades 5 in Fig. 2 and the form or situation of the blades is only exemplary. Blades 5 can be arranged, if desired, at an angle to the cross direction of the shafts. Consequently, the gap formed by the blades of two shafts, respectively, changes its width during use, which improves

the pulverization and mixing of soil.

Since shafts 4 are generally not situated on the same line, sprocket wheels 10 can be provided with double wheels to ensure the draw, whereby adjacent sprocket wheels are so joined in pairs with the chain that the chain from the hydraulic motor 6 rotates the first shaft with the aid of the outer sprocket wheel, and the inner sprocket wheel of the first shaft is joined with the inner sprocket wheel of the second shaft by a chain, and the outer one of the second shaft to the outer sprocket wheel of the third shaft by its own chain and so on.

As mentioned before, it is very much preferred to connect the device according to the invention to the excavator bucket, whereby it is unnecessary to purchase extra working implements. The same excavator scoops with its bucket an appropriate amount of soil to be processed, transfers the bucket above the body of the waiting truck, and actuates hydraulic motor 6 or similar driving means which synchronously rotates shafts 4 with blades 5, whereby the processed soil falls from the space between the shafts onto the vehicle body. This procedure is repeated as necessary.

The present invention is easy to adapt to even larger units such as carriage-type constructions, whereupon a separate loader has to be provided; a simple canstruction, substantial cost savings and a reliable operation even in rain and in the case of wet soil is achieved, however.

Experimental tests have proved that the device according to the invention brings about another great advantage compared to prior art, namely, the device according to the invention provides an accurate and reliable separation of ingredients not wanted in the processed mass. This means that stones and stocks are cleared very carefully, but remain in the bucket not causing any invonvenience to the operation of the device. This is due to the fact that the shafts are

so synchronized with each other that they all rotate in the same direction, and that there is a sufficient number of blades, whereby the space between the blades is always occupied by an ascending blade, while the blade of the adjacent shaft or the adjacent blades are descending. In addition, the space between the blades remains so small that larger pieces will not fit. Stones and roots can then be dumped out of the bucket after the desired soil has passed through the device, and before it is refilled with a new load of soil.

The invention has been described above as adapted to a conventional excavator bucket where the filling of the bucket is carried out by pulling the bucket towards the excavator. However, the device according to the invention is also very adaptable in practice to what is called a dipper shovel, which is filled by a movement directed away from the excavator. Such bucket is advantageous in that it can be lifted fully up, i.e., with the mouth facing straight up, with respect to its geometry, whereby the cinder sheet previously described may be omitted, because stones and the like can only be hurled upwards.

Claims

1. A device for the processing and mixing of soil, especially topsoil, mud and the like, comprising essentially parallel and synchronously rotatable shafts (4), which are situated at a distance from each other, and which comprise essentially radially extending blades (5), characterized in that the blades (5) overlap the blades of the adjacent shaft (4).

2. A device according to Claim 1, characterized in that in that the blades (5) are situated with their blade direction at an angle to the cross direction of the shaft (4).

3. A device according to Claim 1, characterized in that in that the blades (5) are situated, on the cross section of the shaft, in groups, e.g., in groups formed by four blades.

4. A device according to Claim 3, characterized in that in that the blades (5) of the set of blades of the shaft (4) form, in the longitudinal direction of the same shaft, an angle of 30-60° with the respective blades of the subsequent set of blades.

5. A device according to Claim 1, characterized in that the shafts (4) are intended to be rotatable synchronously in the same direction, preferably by a hydraulic motor (6), the driving force of which is supplied by the hydraulic system of the working implement.

6. A device according to Claim 5, characterized in that the power transmitting means between the hydraulic motor and the shafts is a chain or a cogged wheel.

7. The utilization of the device according to any of the preceding Claims, as adapted to the bucket of an excavator, loader or similar working implement.

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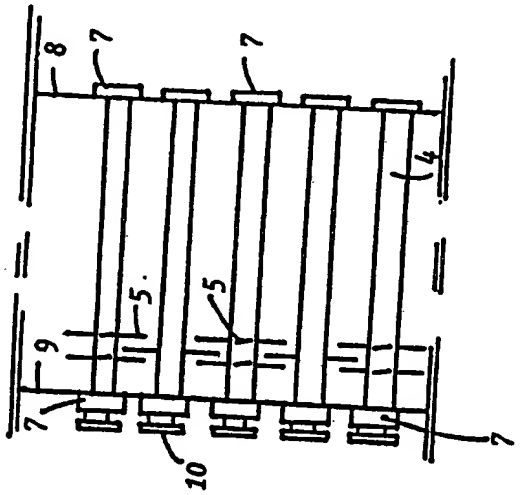

FIG. 2

FIG. 2

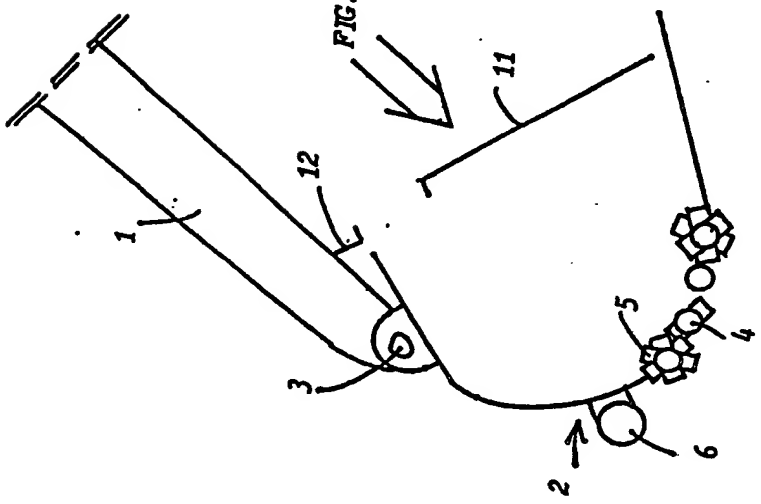

FIG. 1

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 91/00155

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: E 02 F 3/40

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 01 B; A 01 D; E 02 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	DE, A1, 3046474 (KRINNER, HERMANN) 22 July 1982, see the whole document --	1-7
A	DE, A1, 3402269 (GEWERKSCHAFT UCHTE-TORFWERKE) 1 August 1985, see the whole document --	1-7
A	WO, A1, 9003230 (JACKSON, DAVID, GRAHAM) 5 April 1990, see the whole document --	1-7

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
19th August 1991	1991 -08- 21
International Searching Authority	**Signature of Authorized Officer**
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 91/00155

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A1- 3046474	82-07-22	NONE		
DE-A1- 3402269	85-08-01	NONE		
WO-A1- 9003230	90-04-05	AU-D-	4322889	90-04-18
		US-A-	4872977	89-10-10